United States
Department of
Agriculture

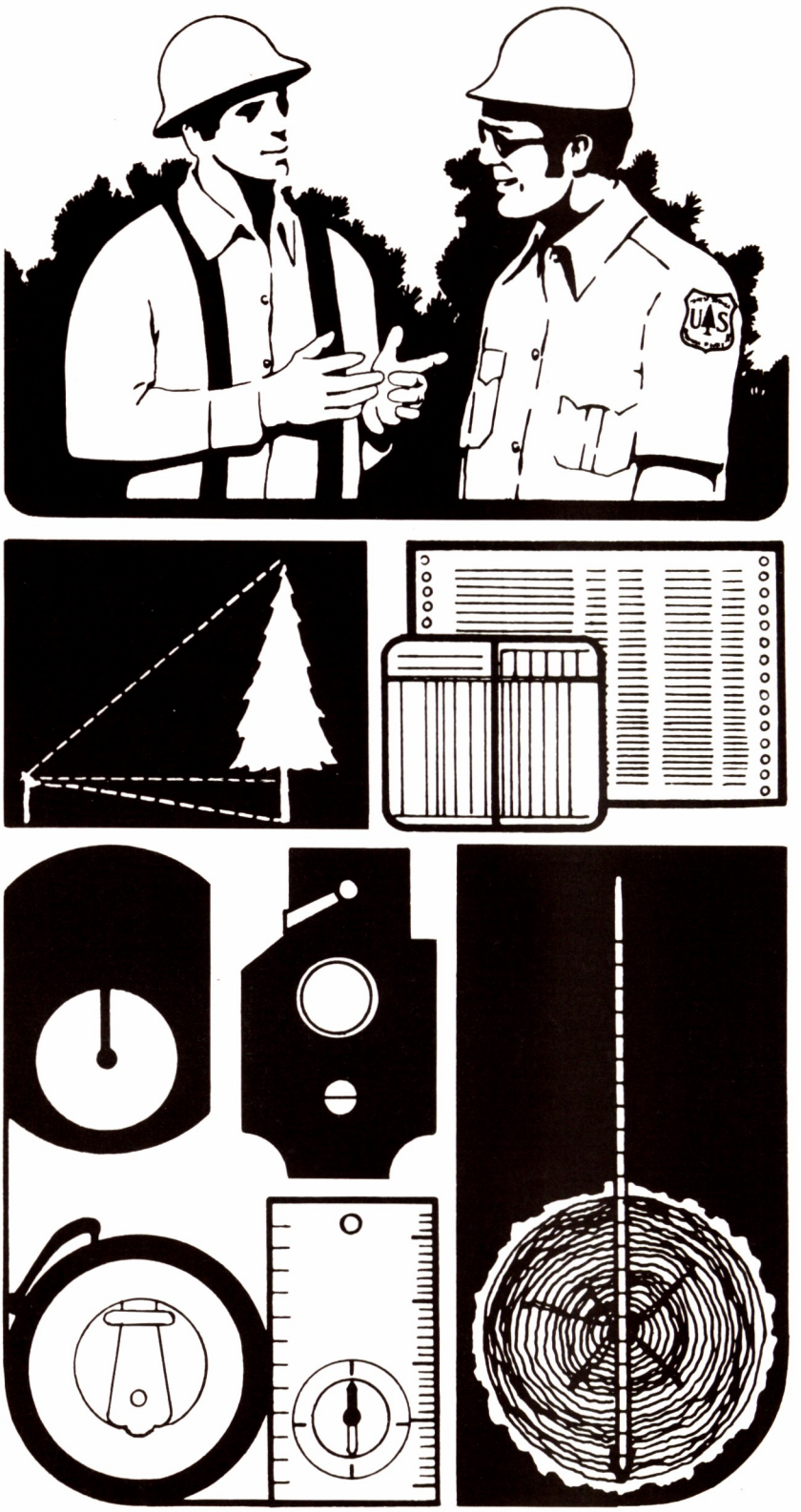
Forest
Service

**Productivity
Improvement
Team**

October 1984

Timber Sale Volume

A Productivity Improvement Analysis



A PRODUCTIVITY IMPROVEMENT ANALYSIS - TIMBER SALE VOLUME

TEAM MEMBERS

Gary Allen, Timber Staff Officer, Payette NF, R-4
*Joe Barratt, Timber Staff Officer, Plumas NF, R-5
Bob Devlin, Forest Supervisor, Rogue River NF, R-6
Jim Gladen, District Ranger, Idaho Panhandle NF, R-1
Jack Reichert, Forest Silviculturist, Ouachita NF, R-8
Dave Spores, Assistant Staff Director, Sales, WO-TM
**Christine Walsh, Assistant Administrative Officer, Six Rivers NF, R-5

*Team Leader
**Facilitator

FOREWORD

Objective

The objective of this analysis is to identify ways to increase productivity or to reduce costs in timber sale volume determination.

Process

The Chief appointed a team consisting of a District Ranger, two Forest Timber Staff Officers, a Forest Silviculturist, a Forest Supervisor, a WO Timber Staff person, and a Facilitator to review Forest Service timber sale volume determination procedures and recommend changes that would either increase productivity or reduce costs. After convening in April 1984, the team interviewed people at all levels of the Forest Service and consulted with other government agencies and private industry throughout the United States. Forest Service, GAO, OIG, and Congressional reports on sale volume determination were reviewed, and a questionnaire was mailed to all National Forests to gather information on current practices and costs. The team defined and evaluated potential issues, selected those with the most promise, and developed them into final recommendations.

This process resulted in three categories of issues, each of which is documented: (1) sixty-three issues identified for initial screening (Initial List of Issues Considered, pages 25-26), (2) ten issues that survived the initial screening and were explored in greater detail, but which did not become recommendations (Issues Considered But Not Included In Recommendations, pages 27-32), and (3) seven issues that became recommendations (pages 1-24).

Some issues involving potential savings were not recommended by this team but may warrant consideration by a future PIT or other study team. These are not recommendations because (1) other recommendations offer greater savings or ease of implementation, (2) implementation would exceed the PIT's mandate of 1 to 2 years, or (3) emerging technology or programs are involved, which are not yet dependable for continuous savings.

The advice and assistance of dozens of people enabled the PIT to complete its assignment. Their help is greatly appreciated. A few individuals, whose contributions were vital, deserve special recognition:

Susan Bristol, Idaho Panhandle NF
Ken Casaday, Plumas NF
Corinne Kolz, Plumas NF
Diane Lowder, Ouachita NF
Nancy Mac, Plumas NF
John McRoberts, R4-TM
B.J. Rhyno, Rogue River NF
Computer Science Section, Six Rivers NF

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Of some 63 aspects of Forest Service timber sale volume determination having potential for improved efficiency, the following seven issues involve the greatest potential for improving efficiency over the next few years. When all recommended changes for these issues have been implemented, the savings in appropriated dollars will be at least $6,900,000 per year. With aggressive implementation, full savings can be realized in 2 to 3 years.

Issue 1. Field Data Recorders

Electronic data recorders could replace hand data recording to gather cruise and log scaling data on Districts having high workloads. An aggressive conversion program for these Districts could be completed by October 1986, saving an estimated 28 FTE-equivalents and $360,000 per year.

Issue 2. Cruising Standards

The Forest Service spends more money than necessary to determine timber volume prior to sale. A significant amount of this money is expended by measuring more sample trees than is statistically justified and by employing excessive sampling error standards. Most Forests are taking considerably more samples than needed to meet existing Regional standards. In addition, since sampling error standards vary by Region, some Regions are measuring four times as many trees to determine estimated sale volume as do other Regions under similar circumstances. If (1) sampling error standards were made less stringent and more uniform throughout the Forest Service, and (2) field sampling were held to the minimum necessary to meet the established standards, an estimated $1,800,000 to $2,700,000 per year could be saved.

Issue 3. Log Grading

Log grading of standing trees is one method of obtaining information to estimate timber quality and, thus, value. Procedures vary by Region and by species; some methods are simple and inexpensive, while others are time consuming and costly. As with cruising, over-sampling for log grades creates unnecessary expense. If present log grading procedures were replaced with simple tree-quality estimators for all but the highest quality timber stands, and if over-sampling was reduced, the Forest Service could save about $340,000 per year.

Issue 4. Data Management

Data collection and management for timber inventory, stand examination, compartment examination, and sale volume determination are subject to different standards and objectives. These vary by Region and, in some instances, by Forest. Data collection in many cases is overlapping. Regional timber data management programs need analysis to define data requirements by task, to compare these data requirements, and to identify opportunities to consolidate or tier data collection. Each Region should complete this analysis by December 1985. Implementation of findings would require several years. Potential savings are conservatively estimated to be $1,600,000 per year.

Issue 5. Technology and Information Transfer

Technology and procedures being used in one unit are frequently unknown to others. Effective sharing of these innovations with other units would improve productivity or reduce costs. National or Regional clearinghouses are needed for this purpose. Resultant cost savings are impossible to quantify, but they would definitely exceed the cost of establishing and maintaining the system. By providing all employees access to and recognition by the clearinghouse, the productivity improvement process would expand from teams to the entire organization.

Issue 6. Log Scaling

About $21,000,000 is spent annually to scale about 9 billion board feet of National Forest timber. Nearly two-thirds of this volume is 100 percent-scaled. The remaining one-third is sample-scaled, using one of several proven methods. Regions 1 through 6 cost data shows that the government spends about $2.87/MBF to 100 percent-scale, while sample-scaling in those Regions costs about $1.39/MBF. If sample-scaling is substituted for 100 percent-scaling where appropriate, up to $3,000,000 per year could be saved. The full savings would not be realized before 3 to 5 years. Most of the savings would be in the form of increased advertised rates, since third-party scaling is involved. About $150,000 of the annual savings would be in appropriated funds.

Issue 7. Less Expensive Methods for Selling Timber

Each year the National Forest System spends about $37,000,000 determining timber volumes by cruising timber for appraisal purposes and scaling logs or measuring trees for payment purposes.

Timber volume determination is the most expensive part of establishing the appraised value and determining final payment for timber sales. Forest Service practices in this area are greatly influenced by tradition and timber purchaser desire. Both factors tend to cause retention of current practices or changes to achieve greater accuracy, usually at higher cost. Although most of the issues already discussed address improving present practices to increase cost-effectiveness, this issue addresses completely different ways to sell timber that could eliminate or significantly reduce the need for cruising and scaling. Consequently, these recommendations are expected to meet considerable opposition, both internally and from timber purchasers or third-party scaling organizations. However, no study of cost savings would be complete without including an analysis of different, lower cost methods of measuring and selling timber.

By designing sales procedures that limit information developed by the Forest Service to the minimum needed to determine "fair market value" as required by law, the Forest Service could significantly reduce the cost of volume determination. This could require more work, and perhaps the assumption of more risk, by prospective bidders on timber sales.

If this recommendation is adopted and implemented, savings of $4,300,000 in FY 1986 and $10,400,000 in FY 1987 would be expected. In addition, a FTE reduction could result.

TIMBER SALE VOLUME
PRODUCTIVITY IMPROVEMENT STUDY
IMPLEMENTATION PLAN

Action	Responsible Unit	Completion Date
Issue 1. Field Data Recorders		
a. Capitalize on existing Forest Service expertise, establish standards, and obtain USDA approval to purchase recorders. (Also refer to NART-Other, Recommendation #5.)	WO,CS&T	4/01/85
b. Regions develop software for field data recorders. Give highest priority to largest savings opportunities.	Regional Foresters	9/30/85
c. All Forests use field electronic data recorders where it is cost-effective.	Regional Foresters	9/30/86
Issue 2. Cruising Standards		
a. Revise FSM to provide criteria for Regions to evaluate and establish uniform cruising standards. Criteria to include: values-at-risk, not exceeding sampling standards, emphasis on cruise design, and cost-effective follow-up action on under-sampled sales. Evaluate alternatives for Service-wide program instruction for training.	WO,TM	6/01/85
b. Regions use FSM criteria to assess existing standards, revise standards where needed, and implement.	Regional Foresters	10/01/85
c. Regions complete training in cruise design by September 30, 1986.	Regional Foresters	9/30/86

Action	Responsible Unit	Completion Date
Issue 3. Log Grading		
a. Revise FSM to require efficient selling value estimation methods.	WO-TM	6/01/85
b. Issue letter requiring RF's to evalute current log grading and tree grading procedures and to eliminate log grading in situations where more cost-effective procedures can be used.	WO-TM	4/01/85
c. Regional Foresters complete review, and report findings and progress to Chief and implement changes.	Regional Foresters	4/01/86
Issue 4. Data Management		
Direct Regional Foresters to analyze Regional TM data collection programs. Analysis should define data required by task, compare data requirements, and identify data consolidations (integration with other resource needs) or tiering opportunities.		
a. Letter to Regional Foresters	Chief	4/01/85
b. Regional Foresters implement and notify Chief of action taken.	Regional Foresters	3/31/86
Issue 5. Technology And Information Transfer		
a. Direct TM to establish a simple low cost electronic bulletin board or similar system at Fort Collins for timber management ideas and suggestions.	Chief	6/01/85
b. Revive Timber Tips or similar publication on semi-annual basis, with first new issue published by September 30, 1985.	WO-TM	9/30/85
c. Revise FSM for incentives program, increasing Forest Supervisor and District Ranger authority for granting monetary awards for employee suggestions	WO-TM	12/31/85

Action	Responsible Unit	Completion Date
c. (continued) and establishing firm turnaround time for review of suggestions. (Also a recommendation of NART.)		
Issue 6. Log Scaling		
a. Direct Regions 5 and 6 to analyze their 100% scaling operations to identify situations where sample scaling would be statistically sound and cost-effective.	Chief	6/01/85
b. For TSC's advertised after 1/1/86, Regional Foresters implement sample scaling for sales scaled by Forest Service where analysis shows (a) sample scaling is more cost-effective than 100% scaling, and (b) the statistical sample intensity indicates that 100% scaling is not necessary.	Regional Forester	1/01/86
c. Meet with industry representatives to develop common objectives and procedures for implementing TPSO sample-scaling.	WO-TM	9/01/85
Issue 7. Less Expensive Methods of Selling Timber		
a. Revise FSM 2430 to fully describe the options available for selling and measuring timber volumes and the criteria for using these methods (i.e., weighing, tree count, and truckload sales with simplified cruises and no scaling). Emphasize that all options resulting in net monetary benefit are appropriate for use.	WO-TM	9/30/85
b. Direct Regions to implement cost saving sales that require no intensive cruising or scaling in cases where FSM criteria are met.	WO-TM	9/30/85

Action	Responsible Unit	Completion Date
c. Explore development of alternatives to traditional appraisal on low value sales, such as expansion of use of "Standard Rates".	WO-TM	Continuing

ISSUES AND RECOMMENDATIONS

Issue 1. Field Data Recorders

Issue Statement:

New electronic data recording technology offers potential for more cost-effective and accurate data recording and reduction than established manual methods.

Current Situation:

All National Forest timber volume determinations (e.g. plot cruising, tree measurement, and log scaling) require data gathering in field, the mill yard, or other locations away from the District offices. This data is collected by hand and delivered to the District offices where it is audited for error. The data is then processed for volume determination in several ways including:

- hand computation on the District
- data key punch on the District
- data transmittal to the Supervisor's Office for re-audit and input to Fort Collins
- data transmittal directly to the Regional Office for further processing
- data audit by the Supervisor's Office and transmittal to the Regional Office for input to Fort Collins by FS personnel or a contractor.

These methods of data collection and processing entail problems of cost, error, and delay. Costs arise in auditing and keypunching. Errors occur due to illegible handwriting, data transposition, and keypunching. Time for receiving volume printouts can be several weeks.

Electronic field data recorders are increasingly being used to increase data gathering efficiency and decrease data reduction time and costs. Although National Forest experiment stations and some timber growing companies have used these recorders for several years, only in the past two years have the National Forests begun using these machines. Use for timber volume determination is still limited to a few Forests, mostly on an experimental basis.

Product development has been rapid in the past few months. Models are now available which use BASIC language, have local programming and communication capability, and can operate under field conditions. Through the programmed process of automatic data editing, errors are being reduced, and the time and cost of data audit, correction, and keypunch is being eliminated. Data is then being processed through Fort Collins or local computers, and a printout of the data can be received the following day. Field crews in R-4 and R-8 have enthusiastically adopted use of this new tool (Automating The Timber Sale Tally System, Evaluation Report No. 1. Ozark - St. Francis National Forest. 5/84).

Electronic field recorders can also be used in recording data for prescriptions, plantation survival, progeny tests, road surveys, and boundary traverses.

Recommended Actions:

A. Assign to the computer sciences and telecommunications staff responsibility for gathering, summarizing, and disseminating information about electronic data recorders. This information should include a list of available hardware and software suitable for use at the Forest and District levels. Current purchasing authority for these machines should be reviewed and recommendations made to expedite purchase. This information should be available for use by April 1985.

B. Direct each Region to select at least two Forests to develop, test, and refine programs suitable for the entire Region's needs, using the information from action A. This testing should be completed by April 1986.

C. Require Regions to convert Districts from manual tally systems to data recorders by October 1986 where it will be cost-effective, based on actions A and B.

Anticipated Results:

Changing from manual to electronic data recording systems will improve field efficiency while reducing errors, workforce needs, and costs. An estimated service-wide time savings of 28 full-time employee equivalents (FTE's) would be expected in the first year after full implementation. (Position elimination would not necessarily result, since this task is included within a broader position responsibility). An average annual savings of $360,000 would be expected over the estimated eight year life of the recorders (based on the purchase of 850 recorders). See Appendix 1 for a cost analysis.

In summary, the advantages of using data recorders will be:

- reduced operating costs
- reduced workforce needs
- increased accuracy
- general acceptability to field crews
- short turnaround for volume summary
- no resistance from industry
- stimulus to use by other disciplines, further increasing cost savings.

Disadvantages are or may be:

- initial expenses for purchasing recorders, developing programs, and training
- possibly some internal resistance
- possibly costs of recollecting field data if recorders malfunction, are lost, or are destroyed.

Issue 2. Cruising Standards

Issue Statement:

The Forest Service is spending more money than necessary for timber sale volume determination. Nearly every Forest in every Region is over-sampling timber sales compared to each Region's standards. Variations between Regions in maximum acceptable sampling errors, and thus in the number of required samples, are considerable.

Current Situation:

Each Region has established maximum acceptable sampling errors for timber sale volume determination. These vary significantly between Regions, ranging from 2% at two standard deviations (equivalent to 1% at one standard deviation) in Region 3, for tree measurement sales over $200,000 in value, to 10% at one standard deviation (equivalent to 20% at two standard deviations) for scaled sales in Region 1.

Some Regions have established different maximum sampling errors according to value, product, species, or type of cruise employed. However, little correlation between standards of different Regions is apparent. A display of the Regional maximum acceptable sampling errors is shown in Appendix 2.

Differences in acceptable sampling error standards result in different sampling intensities. For a scaled sale, Region 3 standards require approximately four times the samples (measured trees) than do those of Region 1. Likewise, for tree measurement sales valued at over $200,000, Region 3 standards require five or more times the samples than do those of Region 4. These wide variations in sampling error standards indicate that some Regions require the taking of more samples than may be needed.

In addition, Regions 5 and 10 decrease the required sampling intensity when a more accurate measurement technique (fall, buck, and scale) is applied. However, according to J.R. Dilworth (Log Scaling and Timber Cruising), measurement accuracy is not a proper determinant of cruise intensity. Thus, it is inappropriate to vary sampling intensity according to the accuracy of measurement technique.

Not only are many established sampling error standards higher than necessary, but nearly every Forest exceeds the sampling intensity necessary to meet the individual Regional standards. The average sampling error for 113 sales on five National Forests in Region 8

ranged from 1.8% to 3.1%, compared to the 5% standard applicable to most of the sales. This indicates that sampling intensities were 2 to 4 times greater than needed.

In Region 3, where a 10% maximum sampling error is required, the average sampling error for 12 sales involving nearly 150 MMBF was 4.4%. In Region 2, which requires a 16% maximum sampling error, an average sampling error of 4.8% was achieved for 17 sales totalling over than 60 MMBF.

At least two Forests in Region 8, with a combined annual timber sale program in excess of 100 MMBF, use 100% tree measurement instead of a sampling program.

Region 6 probably comes as close as any to approximating the established standard (5%). An average sampling error of 4.6% was achieved for over 165 timber sales from eight National Forests. However, the range of averages by Forest was 5.8% to 3.4%, indicating that significant reductions in sampling intensity are still possible.

It must be remembered that the sampling error does not indicate the accuracy of the cruise. Rather, it indicates the probability that the sample represents the sale as a whole. While Region 6 achieves an average sampling error below the established standard, the cruises are not necessarily accurate. Dr. Mead's analysis of timber sale cruise accuracy in National Forests of the western Cascade Mountains from 1979 to 1983 found the average (absolute value) error of cut-to-cruise volume to be over 24%. Although not as thoroughly studied, cruise inaccuracy in other Regions is also indicated.

Many factors contribute to inaccurate cruising: poor volume tables, inexperienced cruisers, poor workmanship, inappropriately designed cruises, etc. Again, increased sampling intensity will not compensate for these errors, inaccuracies, or biases, but it will always increase cost.

It is estimated that between 16 and 18% of Forest Service sale preparation costs are incurred in timber sale volume estimation. Thus, of the 101.5 million dollar sale preparation budget for FY 1984, 18 million dollars will be spent in determining presale timber volumes. It is apparent that significant savings in this area can be accomplished.

In summary, the following points can be made:

1. Some Regional sampling error standards are more stringent than necessary to adequately determine timber sale volume.

2. Most Forests are consistently over-sampling proposed timber sales in comparison to the Regional standards.

3. Some Forests are 100% tree-measuring all timber sales when a sampling procedure would suffice.

4. Factors other than sampling intensity are contributing to inaccurate cruises.

5. Some Regions may be inappropriately varying sampling intensities on the basis of the accuracy of the measurement process used.

6. The use of different standard deviations by different Regions leads to confusion.

7. Proper cruise design and timber type stratification can substantially reduce the number of samples needed to meet established sampling intensity standards.

8. Variations in sampling intensity standards by location, purpose, value, etc., are justifiable.

It should be noted that a National Measurement Task Force is also studying sampling intensity standards at present.

Recommended Actions:

A. Require Forests to use a sampling process for presale volume determination, where applicable.

B. Establish interim service-wide volume sampling intensity standards pending the development of an acceptable process for determining sampling standards by Forest on a value-at-risk basis. Require Forests to meet, but not exceed, the established standards. Instruct Forests to inform potential purchasers, through the timber sale prospectus, if the established sampling standard has not been met, rather than re-cruise a sale.

   This will eliminate the wide variation between Regions and provide the opportunity to reduce sampling (cruising) costs during the 1985 field season.

C. Provide improved training in statistical population sampling aspects of cruise design to promote state-of-the-art practices at the Forest and District levels.

D. Develop a uniform process for establishing acceptable volume sampling intensity standards on a value-at-risk basis, for Forest use (see Action B above).

Anticipated Results:

The recommended actions would reduce the amount of tree measurement required for Forest Service presale volume determination. An expected 10 to 15% reduction in the current 18 million dollar cruising cost would result in savings of $1.8 to $2.7 million annually, beginning in FY 1986. An estimated 70-110 FTE's would be saved yearly.

Overall field measurements may be reduced by 30 to 40 percent. Travel time to the site where measurements will be taken is the most significant cruising cost; in many situations it would remain constant even though sampling intensity were reduced. The costs of designing cruises would remain the same or possibly increase.

Although savings can be realized in FY 1985 if the recommended changes are implemented, they would be partially offset by increased costs for cruise training.

Additional advantages of the recommendations are:

- increased awareness of the cruising program and the value of understanding sampling procedures, which will improve efficiency

- less internal and external confusion resulting from differences in standards between Regions.

Disadvantages are:

- added cost to purchasers if Forest Service estimates are less accurate than needed by purchasers

- opposition from industry, viewing these changes as a shift of workload and risk from the Forest Service to industry

- an increased risk that presale volume estimates will not accurately reflect actual sales conditions

- internal resistance, as people are asked to change a practice they have used for years

- initial cost increases for training.

Issue 3. Log Grading

Issue Statement:

Opportunities exist to reduce time and money spent determining timber value by modifying or eliminating log grading.

Current Situation:

Presently most Regions of the Forest Service use log grading for some tree species to estimate the value of lumber that could be produced. Grading is most appropriate for estimating the value of stands containing large, high quality timber. Grading is less important where the log value range is relatively narrow or where high-value trees are sparse and contribute relatively little to overall timber stand value.

Forest Service policy for priority harvest of the oldest, most decadent stands, which generally include the largest trees, is resulting in an inventory of more uniform, lower-grade timber. This increases the opportunity for less complex and more cost-effective value estimating methods.

However, National Forests in the West still contain considerable high-quality, old growth timber where individual log grading is appropriate. Harvesting this timber will require several decades. Therefore, any revision of value estimating policy should retain current methods for this higher value timber, while adopting more cost-effective procedures for the lower value timber.

True fir and eastside pine types in Region 5's Sierra-Nevada are environments where log grading could possibly be eliminated without detriment to timber appraisals. True fir log grading could be eliminated because of the small average value difference between log grades. Since the spread in value between high and low grade true fir in Region 5 has only been 2 to 3% of average value for the past two years, appraisals based on tree diameter alone appear to be an adequate substitute for log grading. This procedure would be the same as is currently used in Region 5 for young-growth timber.

Eastside pine log grading could be eliminated in much, or perhaps most, of Regions 5 and 6 as a result of past sanitation harvesting of the largest, highest value trees. Resulting stands have lower and more constant values. In many areas, such as the eastside of the Plumas National Forest, the ponderosa-Jeffrey pine values appear to be sufficiently uniform to allow appraisal based only on tree diameter.

Each Region can best determine where less costly selling value estimation methods can be substituted for present procedures. According to this study, the greatest opportunities for change appear to be in the western Regions, especially Regions 5 and 6, but other areas should be similarly evaluated.

Recommended Action:

Review present log grading or other selling value determination procedures in each Region and eliminate or simplify procedures where possible.

Anticipated Results:

Changes in value determination procedures can be made without serious problems. However, only Regional evaluation of opportunities can determine the proper extent and timing of such changes. Since parties outside of the FS would be affected by these changes, they should be involved in the change process.

Presently the Forest Service spends about $900,000 per year for log grading. Revised procedures could reduce costs by approximately $340,000 per year, depending on each Region's resolution. See Appendix 3 for cost savings estimates.

Advantages of reduced log grading may be:

- time and cost savings in adequately determining timber values
- less complicated procedures which could result in better quality field work.

Disadvantages may be:

- disruption of traditional methods of estimating selling values, causing timber purchasers and private appraisers to establish new methods of correlating timber values to Forest Service appraisals
- costs of evaluating opportunities and implementing changes
- possible research costs if new grading procedures are proposed.

Issue 4. Data Management

Issue Statement:

Opportunities exist to eliminate redundant collection of timber volume information and to reduce costs.

Current Situation:

Data collection for the tasks of Timber Management Plan inventory, stand examination, compartment examination, and sale volume determination is undertaken according to various standards and objectives. These criteria differ not only by task and ultimate use of the data, but also by Region and perhaps even by Forest. Moreover, the objectives of data collection are sometimes difficult to ascertain.

Attempts to consolidate data collection are being made in some Regions. In Region 6, for example, an analysis to compare required data acquisition processes, techniques, and data use is scheduled for completion in the second quarter of FY 1985.

It is recognized that, prior to determining possible consolidations of data and related savings, the objectives, intended use of information in relation to other Timber Management tasks, and standards for data collection need to be defined for each task. Although potential savings in workforce and expenditures are evident, more time is needed for examination of this issue than was available for this study. Thus, this issue should be treated as a future action item.

Recommended Action:

Instruct Regional Foresters to analyze Regional timber management data collection programs, including analysis of opportunities for personnel and expenditure savings. This direction should be given to the Regional Foresters by April of 1985, requiring completion and reporting to the Chief by December 1985.

These analyses should include determinations of data required for each task (i.e., stand exam, inventory, compartment exam, sale volume determination, etc.), should compare these data requirements, should identify opportunities where consolidation and/or tiering of data collection will be more cost-efficient, and should involve a review of the standards for data collection for each task. It is recognized that these standards may need to be adjusted to allow future data consolidation with other Timber Management needs.

Anticipated Results:

These analyses will highlight opportunities for data consolidation and/or tiering and improving standards for data collection. The recommended time frame allows each Region to examine its own needs. The process will summarize for the Chief most of the differences between Regions and may result in future cost savings.

There are no identifed political implications either for or against the recommended action, although any resulting increases in operating efficiency will be well received.

In some Regions the various Timber Management tasks originate in different departments. Thus, the recommended analyses will cause better understanding between these departments of each other's needs and standards, in itself a positive effect.

Cost savings are difficult to project until the analysis by Region is complete. The 1984 Forest Service budget for timber management included approximately $10.8 million for timber resource planning (P&M 032), $21.6 million for silvicultural examinations (P&M 037), and an estimated $20 million for timber inventory, compartment examination, silviculture examination, and sale volume determination (a portion of P&M 030). Thus, activities financed by approximately $52.4 million annually are subject to the recommended analysis action. Considering the advantages and disadvantages stated below, a conservative estimate of savings is 2-3%, or up to $1.6 million per year. Actual savings may be larger if the Regional analyses identify increased opportunities.

Advantages of the recommended action are:

- potential savings of time and expenditures for data collection
- updated definition of data necesssary for each timber management task and the appropriate standards for collection
- potential for uniformity between Regions
- possible reduction in lines of data input for each Timber Management task
- potential reduction in duplication of data reporting
- possible longer storage of some data, making it available for future tasks

Disadvantages are:

- possible need for additional employee training and changes in contract language
- possible added storage costs if longer data storage is adopted
- a highlighting of major operating discrepancies between Regions
- costs to complete the analysis and for the Chief's review
- possible resistance to change, both between and within Regions, if change is ultimately recommended

Issue 5. Technology and Information Transfer

Issue Statement:

The Forest Service is not effectively using the newest concepts and technologies that increase efficiency and reduce costs in sale volume determination. Innovative ideas for new applications are not sufficiently recognized and disseminated throughout the system.

Current Situation:

Innovations in measurement technology and application are being studied, tested, and implemented at the Ranger District and Forest levels. Field data recorders for cruising and scaling are being tested on Districts from Idaho to Arkansas. Estimating and selling volume on an area basis for low value species is being tried on Forests in Montana and Colorado. Satellite imagery for Forest inventory is being used in Regions 5 and 6. Many other methods of simplifying tasks to improve efficiency and reduce cost are being pursued throughout the National Forest system.

Unfortunately, much of this experimentation is duplicated, and successes are insufficiently shared beyond Forest and Regional boundaries. Morever, Regional priorities and leadership do not appear adequate. Although measurements workshops and productivity improvement teams are studying volume determination procedures, these are generally isolated efforts designed to address specific problems.

Successful use of new concepts and technology requires promotional leadership (e.g., nation-wide use of redi-mappers resulted from Timber Tips). However, difficulties arise in spreading good cost-saving ideas beyond District or Forest boundaries, as advocates often lack time and authority. A system is needed to identify good ideas and to advocate them at the National level. Increased emphasis on technology or information transfer by National and Regional Office managers during the various management reviews and functional assistance trips is warranted.

While it is difficult to estimate potential cost savings of more coordinated innovation, the need for improved information dissemination about new volume determination and selling procedures is apparent.

Recommended Action:

A. Establish a National clearinghouse for timber management-related ideas and proposals for innovative use of new concepts and technology. This system could function as follows:

1. Establish the clearinghouse at Fort Collins under the supervision of Timber Management.

2. Encourage individuals at all organizational levels to submit descriptions of innovative cost-reducing or efficiency-improving techniques that had been locally implemented and found to be successful.

3. Encourage all units to submit proposals for the experimental application of new technology that may result in improved efficiency. Screen proposals to determine if a similar application had already been tried, and, if so, notify the unit as to degree of success.

4. By use of a selected group of three or four individuals from the Forest and Regional levels, review twice yearly all submitted ideas to determine their applicability to other areas of the country. Report recommendations in newsletter form, distributed to the District level.

   Proposals that should now be considered for review include:

   - development of video cassette programs that explain or demonstrate significant cost-saving innovations.

   - development of a National FLIPS Library of ideas for individuals to check for possible solutions to problems.

   - joint seminars between field and research personnel to improve the link between research and the use of new volume measurement technology.

5. Direct the review group to recommend implementation to the Director of Timber Management of those ideas with apparent significant value and national application. Recommendations should include appropriate recognition of the units or individuals involved.

B. Restore Timber Tips, published twice yearly, to distribute worthy ideas and serve as a reward and recognition medium.

C. Increase Forest authority and decrease turnaround times for rewarding worthy suggestions and innovations. As employees experience timely and visible response to submitted suggestions, they will be encouraged to further innovation.

Anticipated Results:

An overall improvement in technology and information transfer, especially in timber management-related areas, would be expected. Duplicated effort would decrease, and efficiency would increase. While neither costs nor savings can presently be estimated, the surfacing of only one idea comparable in value to the redi-mapper would justify the effort required to implement the recommendations.

Improved morale could be expected as employees' ideas were recognized and implemented and efficiency were improved.

Issue 6. Log Scaling

Issue Statement:

The cost to the government of scaling logs to determine volume for payment purposes could be reduced through broader application of proven sampling methods.

Current Situation:

Approximately $21,000,000 are spent annually to scale about 9 billion board feet of National Froest timber for payment purposes. Most of the volume, about 6 billion board feet, is scaled by scaling bureaus at an estimated annual cost of $15 million. The remainder, 3 billion board feet, is scaled by the Forest Service at an estimated annual cost of $6 million. All of this $21 million total cost is ultimately paid for by the federal government, either by direct expenditure or by a reduction in stumpage rates paid by the timber purchaser.

Scaling methods vary widely throughout the National Forest system. This diversity is desirable, since no two scaling situations are exactly alike. Since the value of timber varies by species, geographical area, and product use, the cost of scaling per unit of measure ($/MBF) significantly and appropriately varies between and within Regions. Nevertheless, cost-effectiveness of scaling can be increased where managers are familiar with different scaling methods and their appropriate uses, understand the scaling objectives of each situation, and thereby vary selected methods to meet, but not exceed, the objectives.

Results of an analysis of the current scaling program in Regions 1 through 6 are depicted on Figure 1 and Table 1. Variables include average annual timber volumes and costs by scaling method and scaling party (either the Forest Service or a Third Party Scaling Organization - TPSO). Refer to Appendix 6B for derivation of the data.

The following conclusions can be drawn:

1. 100% scale accounts for 62% of the total volume scaled and 77% of the total scaling cost. Sample-scale accounts for 38% of the total volume scaled and 23% of the total cost.

2. The cost of scaling can probably be significantly reduced by favoring sample-scale over 100%-scale.

3. 3-P sampling is the most cost-effective scaling method.

Figure 1

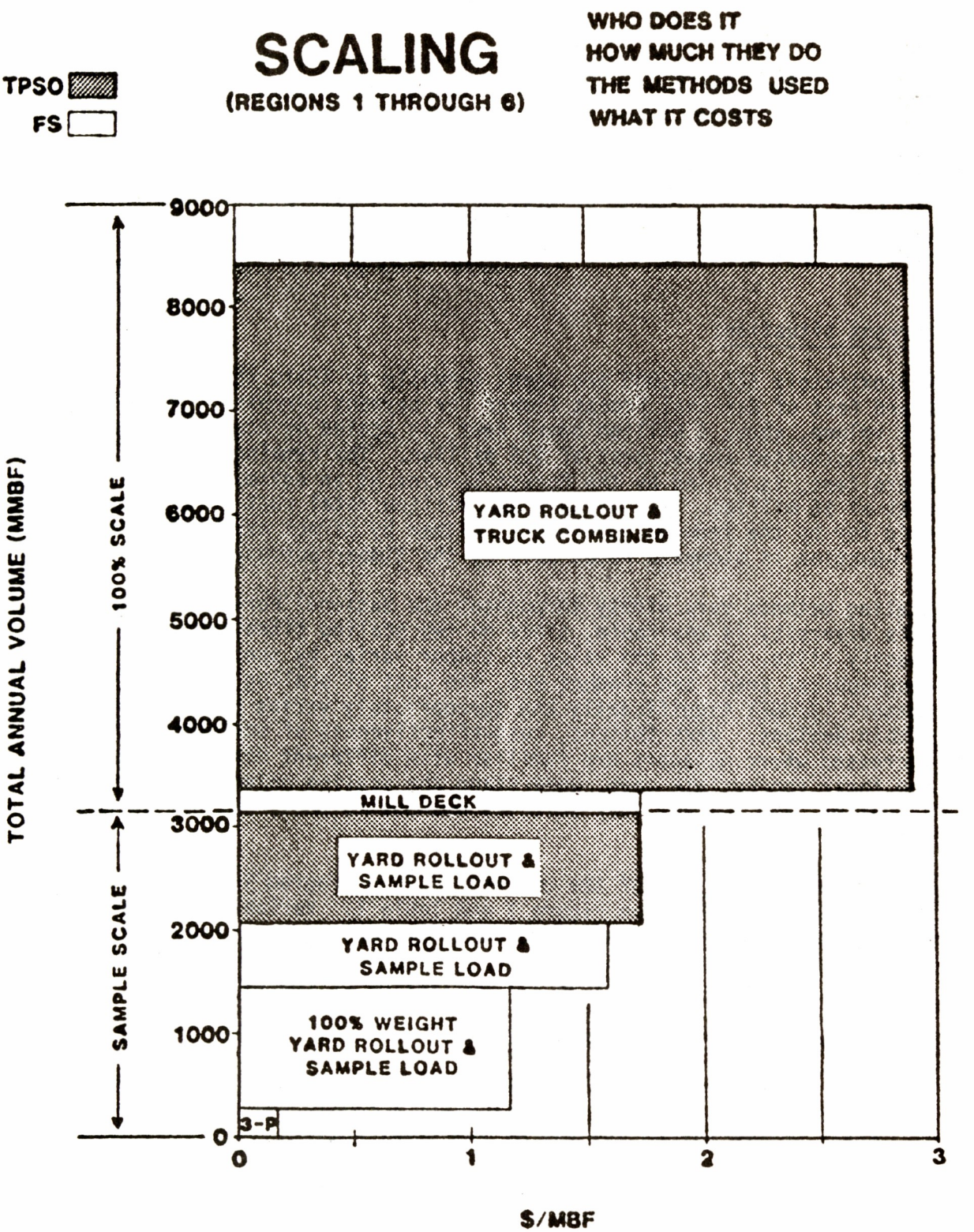

SCALING
(REGIONS 1 THROUGH 6)
WHO DOES IT
HOW MUCH THEY DO
THE METHODS USED
WHAT IT COSTS
TPSO
FS
TOTAL ANNUAL VOLUME (MMBF)
100% SCALE
SAMPLE SCALE
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
YARD ROLLOUT & TRUCK COMBINED
MILL DECK
YARD ROLLOUT & SAMPLE LOAD
YARD ROLLOUT & SAMPLE LOAD
100% WEIGHT YARD ROLLOUT & SAMPLE LOAD
3-P
0
1
2
3
$/MBF

Table 1

VOLUME SCALED ANNUALLY AND RELATED COST BY METHOD AND BY WHO DOES THE SCALING

REGIONS 1 THROUGH 6

Scaling Method	Who Scales	Est. Annual Vol. Scaled (MMBF)	% of Vol. Scaled	Est. Annual Cost in $	% of Cost	Cost Per M	Regions Covered
100% Scale							
Mill Deck	FS	243.0	2.9	436,500	2.2	1.80	R4-5
Yard Roll Out And Truck	TPSO	4,977.5	58.8	14,562,000	74.6	2.93	R5-6
Yard Roll Out	FS	11.0	.1	35,420	.1	3.22	R1-4
Consumer	Purchaser	13.1	.1	1,000	-	-	R3
SUBTOTAL 100%		5,244.6	61.9	15,034,920	76.9		
Sample Scale							
Yard Roll Out	TPSO	1,147.5	13.6	2,065,500	10.7	1.80	R6
Sample Load	FS	657.4	7.8	1,058,103	5.5	1.61	R1-3-4 & 6
100% wt. and Sample Load	FS	1,123.1	13.3	1,302,849	6.8	1.16	R1-3 & 4
3-P	FS	290.0	3.4	56,850	.1	.20	R2
SUBTOTAL SAMPLE		3,218.0	38.1	4,483,302	23.1		
TOTAL ALL		8,462.6	100.0	19,518,222	100.0		

NOTE: The objective was to account for at least 90% of the volume being scaled annually and display enough scaling information to develop reasonably reliable comparisons.

Recommended Action:

Convert from 100%-scaling to sample-scaling where (1) sample scaling is more cost-effective in meeting the government's need for volume information, and (2) the statistical formulas used to determine sample intensity indicate that sample scaling is appropriate.

This recommendation conforms to existing National direction: "Regional Foresters are encouraged to use sample scaling when acceptable accuracy can be obtained and when cost savings can be realized as compared to 100 percent scaling." (FSM 2443.8) The intent is to require the Regions involved with 100 percent scaling to determine through analysis if they are utilizing to the extent possible the potential cost savings associated with sample scaling.

Anticipated Results:

As concluded above, nearly two thirds of the volume scaled annually in Regions 1 through 6 is 100%-scaled. If scaling of this volume (over 5.2 billion board feet) were converted to either "sample load" or "100% weight and sample load", the estimated savings would be as follows:

Sample load	$5.7 million
100% weight and sample load	$8.3 million

If all the volume scaled annually in Regions 1, 3, 4, 5, and 6 were scaled using "3-P" procedures, the estimated savings could reach $17.8 million. (See Appendix 6A.)

Sample-scaling can be done at less average cost than 100%-scaling. In addition, sample-scaling methods (including 3-P) have been tested and are fully operational. When applied properly, they offer acceptable reliability for both the Forest Service and the timber purchaser. Nonetheless, it is unrealistic to assume that the full $17.8 million could be saved because:

1. Situations arise where 100%-scaling is appropriate and should be used.

2. Most of the scaling cost involved (about $15 million) is included as a cost in the timber sale appraisal. If the appraisal cost estimate is reduced, advertised stumpage value will increase, but bid amounts may not. Therefore, the government may not gain revenue even if sample scaling is used. This is less likely to occur in competitive markets, like those in Regions 5 and 6, where the bid value, not appraised rates, generally determines receipts.

3. Regions 5 and 6 have a large timber volume under contract, most of which is covered under multi-sale extensions for up to five years. This could delay change in scaling practices for three or more years. However, the recent timber contract relief legislation could improve the possibility of changing to sample-scaling.

4. Scaling situations are too diverse to assume that cost differences between scaling methods (as tabulated in Table 1) represent linear relationships. For example, the assumption that all Regions can 3-P scale for the same cost experienced by Region 2 may not be completely valid.

In spite of all the uncertainties, expansion of sample scaling could save the government an estimated $1 to $3 million annually. The savings would not immediately occur, due to the time between sale and actual harvest.

The advantages of the recommended action are:

- significant savings to the government
- reduced number of FTE's (fewer scalers and less clerical time).

Disadvantages are:

- possible increased timber purchaser costs (scales for weight scaling)
- a resistance to change from within the Forest Service and the timber industry
- an investment in training, if sample-scaling is new to the unit
- a significant impact on the work force of third party scaling organizations.

Issue 7. Less Expensive Methods of Selling Timber

Issue Statement:

Each year the National Forest System spends about $37 million determining timber volumes for payment purposes both prior to selling (by cruising) and after selling (by scaling). This cost can be reduced, while maintaining receipts, by using less expensive methods of measuring and selling timber products.

Current Situation:

Ensuring that the government receives a fair price for its timber products has been a historical concern of National Forest management. Under authority of the National Forest Management Act of 1976 (16 U.S.C. 472A), timber on National Forests may not be offered for sale for less than appraised value which, according to 36 CFR 223.4, must be based on estimated fair market value. In determining this value, the Forest Service currently determines total timber volume and quality through cruising. In addition, 80% of the volume sold is measured by scaling as it is removed from the forest so as to minimize the risk to both the purchaser and the government.

This timber volume determination is the most expensive part of establishing the appraised value and determining final payment. Table 2 below reflects the current costs of determining volume by cruising and scaling. These costs are a summary of information provided by 86 National Forests (from the June 1984 timber sale volume PIT questionnaire; see Appendix 7).

Table 2
TOTAL COST TO CRUISE AND SCALE
(estimates for 1984)

	Cost (Per MBF)	Volume (Billion BF)	Total Cost (Million $)
Cruise	$1.55	11.7	$18.1
Scale	2.03	9.1 1/	18.5 2/

1/ 2.6 billion BF was sold by tree-measurement with no scaling.

2/ This cost is based on questionnaire results. The total cost of scaling may actually be closer to $21 million as described in Issue 6.

Even with the large amount of money spent on cruising, the result is not always accurate. A 1981 study by Mead, Schniepp, and Thomas, Competition and Appraisals in the Auction Markets for National Forest Timber in the Pacific Northwest, revealed that, although cruise results were within the acceptable sampling error, they did not accurately reflect the amount of volume that was eventually removed. They also found that: (1) bidders invest in their own timber sale cruises, (2) the accuracy of these cruises is superior to Forest Service estimates, and (3) when the Forest Service under/estimates sale volume, firms trust their own cruises and frequently bid more aggressively.

The Surveys and Investigations staff of the House Committee on Appropriations, in a February 1984 report on the timber sales program of the Forest Service, also found wide discrepancies between volume estimates and volume harvested in Regions 5 and 6. Although research has been concentrated on these Regions, other Regions appear to have the same problems with cruise-to-harvest volume accuracy.

Since bids for timber sales are often several times the appraised value, it is questionable whether intensive cruising to establish these appraisals is worthwhile. In response to the need for reduced Federal costs, efforts are being made to decrease the cost of cruising and scaling while maintaining receipts. Examples include:

1. Use of stand exam information in lieu of sale cruise and no scaling.

   Stand exam data could be used for appraisal volume determination and to determine the timber volume and acreage treated.

   This method was used in Region 1 in FY 1984 and is expected to be used in Region 9 in FY 1985. No estimate of volume is provided in the contract, bid, or prospectus. The purchaser is expected to make his own estimate of volume and value. Acreage figures may or may not be provided, depending upon the particular circumstances.

   Because the accuracy of the Forest Service volume estimate is low, a competitive marketplace is necessary to assure a fair return to the government with this method.

2. Weighing as basis for payment (tons).

   The pulp and paper industry, and some lumber mills in the Midwest and East, purchase their material primarily by weight. One Forest in Region 1 has modified, with purchaser approval, a dead lodgepole contract to allow weighing rather than conventional scaling. Between 1976 and 1980, the Targhee National Forest in Region 4 sold over 200 MMBF by weight, resulting in a significant savings.

3. Sell with no appraisal.

   The Bureau of Land Management is currently implementing a no-appraisal sale process which eliminates cruising, appraising, and scaling. The Bureau's position is that, in a competitive market, the fair market value is the highest bid received, regardless of cruise and appraisal estimates. If adequate competition does not occur, an appraisal is completed for the sale prior to awarding the contract. See Martin, 1984, Reducing the Cost of Selling Federal Timber Through Greater Reliance on Market Information.

The current situation can be summarized as follows:

1. The total cost of determining timber volume is high (Table 2). Therefore, reductions in cruising and scaling would result in substantial savings.

2. Where a competitive market for timber exists, intensive Forest Service cruises are not essential to assuring that the government receives fair market value.

3. Options that have lower costs than traditional methods are available for selling and measuring timber.

4. New methods of selling timber that greatly reduce costs need to be explored.

Recommended Actions:

A. Increase the use of the lower cost options for measuring and selling timber products.

B. Require each Region to implement low-cost sales (those without intensive cruising or scaling) where adequate competition exists. Proposed implementation:

FY	% of Total Offered Volume
1986	10%
1987	25%

C. Explore the large savings potential of no-appraisal sales in cooperation with the B.L.M.

Discussion of the Recommended Actions; Alternatives

A. Field units need to fully recognize that important cost savings can result if all volume measuring and selling options are considered. For example, costs may easily be reduced by use of weighing. Where this might be a problem due to lack of scales, the local units should consider options such as measuring and selling by area or by truckload.

   The alternative to Action A is continuation of higher preparation and administration costs.

B. Action B provides a formal policy requiring Regions to adopt more cost-efficient sale methods where adequate competition exists. The recommended phase-in period would allow the Forest Service and industry to become accustomed to the new procedure.

   Alternatives include other methods of measuring or selling, such as by tree count or truckload. These were considered but appear to offer lesser cost savings; they are discussed in Issues Considered But Not Included In Recommendations (page 25).

C. Another alternative is a no-appraisal sales program, such as that used by the Bureau of Land Management. Action C would set the stage for additional cost savings in the future. The no-appraisal method appears to have merit for Forest Service use where competition exits, but uncertainties are sufficient to warrant further study prior to adoption.

Anticipated Results:

The following savings in cruising, scaling, and log accountability would be expected once all recommended actions have been fully implemented.

FY 1986	$ 4.3 million
FY 1987	10.4 million

(See Appendix 7B for savings calculations)

In addition to the cost savings shown above, advantages of implementing the recommended actions are:

- a reduction in FTE's
- a reduction in opportunities for skewed bidding
- less log accountability due to less scaling.

Disadvantages include:

- additional costs incurred by purchasers who do not now obtain their own cruise volumes. This may be reflected in bid price reductions.
- industry resistance to the reduction in sale information provided by the Forest Service
- internal resistance from those who feel exact timber sale volumes should be known even in a competitive market
- opposition from third party scaling organization experiencing a reduced demand for their services.

INITIAL LIST OF ISSUES CONSIDERED

A. Process and Procedures

1. Cruise Design
2. Duplicated Measurement
3. Sample Scale
4. Third Party Scale
5. Contract Scale
6. Consumer Scale
7. Force Account Scale
8. More Count, Less Measure
9. Log Accountability
10. Grading - Log and Tree
11. Fixes Add To Cost
12. Taper - Rule - Scaling
13. Eyeball Cruise
14. Contract Cruise Marking
15. Simplify Cruising
16. Appraisal Process
17. Purchaser Marking
18. Cruising Methods
19. Extrapolated Cruises
20. Quality Control - Comparing
21. Stand Exam and Cruise Data

B. Ways We Sell Volume

1. Gross Scale
2. Sale By Weight
3. Guaranteed Volume
4. Tree Measurement Sale
5. Area Estimate
6. Stewardship Sale
7. Eliminate Species Differences in Contract Value
8. No Bid On Minor Species
9. Average Stumpage Bidding
10. Optional Material
11. Sell/Acre Basis
12. Sell Tree
13. Live Versus Dead
14. Sell Volume Without Defect - Adjust
15. Defect As Part Of Contract Clauses

C. Technology

1. Optical Scanners
2. Satellite Inventory
3. Field Computers - Data Recorders, etc.
4. Standardize Computer Programs
5. Consolidate Inventories
6. Measurement Research

D. Standards

1. Standards Of Accuracy - All
   a. Defect
   b. Log Scale
   c. Tree Measure
   d. Traversing
   e. Scale
   f. Cruise
2. Check Cruise And Scale Standards
   a. Frequency
   b. Accuracy
3. Standards Based On Values And Risk
4. Different Type Measurements Used By Different Functions

E. Workforce

1. Forest Supervisors (more authority)
2. Measurement Expertise
3. Volunteers
4. Inexperienced Workers (temporaries) Necessitate Extra Standards
5. Training
6. Continued Education For Mensuration
7. Employee Awareness and Job Satisfaction Relating To Tasks

F. Policy and Decision Making

1. Certified C.O.'s Give C.O. Authority
2. Log Accountability
3. More Local Decision Making (more authority at local level)
4. Delegation of Authority
5. Firewood Sales (cost versus return)
6. Required Deposits for Measurements
7. Contract Law Review
8. TSC Revisions
9. Volume Tables - Consolidate (internal and/or purchaser, private, BLM, State versions)
10. Silvicultural Prescriptions (effect on costs of measurements)

ISSUES CONSIDERED BUT NOT INCLUDED IN RECOMMENDATIONS

1. Satellite Mapping

One of the initial steps in the timber inventory process is to map timber strata. Traditionally this has been done by manual delineation of strata on aerial photographs and then transfer of the information to maps.

Over the past few years the Forest Service has been experimenting with remote sensing computer imagery from the LANDSAT satellite program to inventory timber. The system has been successfully tested on the El Dorado N.F. in Region 5. Region 5 plans to use satellite timber strata delineation for all future timber inventory projects. Satellite delineation has about the same accuracy as delineation from aerial photographs.

Region 5 is saving about 1.5 cents per acre using satellite delineation as opposed to the conventional method. Applying that savings to approximately 17 million acres of National Forest land in Region 5 yields a potential savings of $255,000 per decade or $25,500 per year (assuming all NF acres were reinventoried on a ten-year cycle). If satellite strata delineation could be applied to all NF land outside Region 5, the estimated savings would be about $1,140,000 per decade or $114,000 per year (assuming 76 million acres and a 10-year reinventory cycle). Additional field testing would be needed to determine if this method is applicable everywhere, especially in eastern hardwood Forests.

The reason satellite mapping is not included as a recommended action is that the LANDSAT program is not currently being funded and no plans to replace LANDSAT with a similar satellite system have been made. Therefore, a switch to this system now would probably require changing to another timber delineation system when the satellites fail, which could occur in a few months or several years. If only used for a short time, satellite mapping would not save money, but it would result in considerable savings if used for many years.

2. Satellite Locators

The Landline Location PIT reported that substantial savings could be made by using Navstar Global Positioning System (GPS) for land surveying. The Sale Volume PIT believes that use of this same technology for mapping timber harvest units may present substantial savings opportunities in the future. This will depend upon the cost

and size of field locator equipment and the time required to obtain an accurate reading. Light-weight equipment and accurate readings within seconds would be extremely valuable. Large, heavy equipment, or the expenditure of several minutes to an hour for accurate readings, would render this technology useless for harvest unit mapping.

Although satellite locators show potential, they cannot feasibly be used for harvest unit mapping at present. The consensus is that cost-effective systems for this purpose will be developed within the next five years.

3. Tree Measurement Sales

Pre-sale tree measurement is a viable method of determining final sale volume. Regions 8 and 9 sell all of their volume by this method, and other Regions are increasing its use. The pre-sale tree measurement issue was reviewed by use of the sale volume determination questionnaire and through discussion with various Regional personnel. The consensus of Regional measurement specialists is that they are moving at the right pace towards tree measurement sales. The reluctance to move faster is because of limited experience, a need to develop better volume tables, and limited funding and personnel. Better acceptance by industry, availability of trained scalers, and the needs of third party scalers are also concerns.

A comparison of costs for pre-sale tree-measurement versus log-scaled sales was made from data received in response to the PIT questionnaire. A summary of this data is shown in Table 3 on the following page.

The cost data is inconclusive regarding potential savings of pre-sale tree-measurement. The volume of timber sold by tree-measurement in the western Regions is too small to yield a reliable conclusion. Nonetheless, the cost per MBF would likely decrease if more timber were sold by tree-measurement, especially as Forest Service personnel became more proficient at tree-measurement procedures. In addition to reducing costs, tree-measurement alleviates log accountability concerns and thereby permits Forest Service personnel to spend more time in the sale area and the Forests in general. Although exact costs and savings are difficult to measure, most Forest Service employees believe tree-measurement sales are cost-effective and make better use of personnel time than scaled-sales. Thus, increased use of tree-measurement sales should be encouraged in the western Regions.

Since tree-measurement sales involve payment for logs in advance, less volume is likely to be left in the woods by purchasers. This can result in further savings, which may be substantial. For example, an estimated $13 million worth of logs cut on the Willamette National Forest in early 1980 were left because of the deteriorated lumber market.

Table 3
QUESTIONNAIRE SUMMARY[1]
TOTAL COST COMPARISON
(Regional Average per MBF)

Region	Number Forests	Number Received	Tree Measurement[2]	MMBF Sold/yr.	Log Scaled[3]	MMBF Sold/yr
1	13	10	$ 8.91	152	$ 8.21	673
2	12	5	6.96	61	11.60	87
3	11	5	7.30	5	4.72	243
4	16	10	6.80	40	8.24	208
5	17	16	8.28	94	6.86	1328
6	19	14	5.39	84	5.09	2901
8	13	10	9.45	1222	0	0
9	14	14	7.00	634	0	0
10	4	2	8.15	13	9.45	203
Averages			$ 7.58		$ 7.74	

1 Summary of data submitted; does not include all Forests in each Region.
2 Includes costs of cruising, marking, and contract administration (questions 8, 8a and 9).
3 Includes costs of cruising, scaling, log accountability, and contract administration (questions 13, 14, 15 and 16).

Acceptance and use of the tree-measurement sale procedure could be accelerated through the use of scaling in the forest to refine tree-measured volume either before or after sale. This can be done through the fell, buck, and scale procedure.

Fell, buck, and scale is designed to supplement the cruise and provide a basis for correcting presale tree measurement volumes for volume table fit and scaling defect. The system is well-established and effective, but the felling job is hazardous, and considerable waste can result. An alternative that is safe and avoids the waste problem is to develop a post-sale correction factor based on scaling a sample of felled trees in the forest prior to skidding. The correction factor is then used to adjust estimated net volume to final net volume for payment purposes. Depending on the cruising situation under consideration, both methods offer a means to improve the reliability of tree-measured volume estimates that would otherwise be in question due to poor volume tables or poor estimates of defect. However, neither method was selected for detailed analysis since significant cost savings were difficult to identify, mostly due to the continued dependence of each on scaling.

Although increased use of tree measurement sales is encouraged, this method of volume determination is not included as a recommendation because considerable pressure for its expanded use already exists. It is also an issue being considered by the Other Business Management Committee of the National Administrative Review Team.

4. Tracer Paint

Another item briefly considered is the policy in FSM 2442.03-3 that all individual tree marking shall be done using tracer paint. This policy is questionable for clearcuts (where all trees are marked) and in areas having no history of trespass. Moreover, courts have varied on the value of tracer paint as evidence, rejecting it in Region 5 but basing some convictions upon it in Region 9. This brings into question the efficacy of the tracer paint policy.

Changing to a more lenient policy for the use of tracer paint would result in a savings of money and workforce. Tracer paint is cheaper than regular marking paint. Less employee time could be spent on the accountability of the tracer paint. This topic was not pursured in detail but is an item that should be considered by future PIT's or for administrative review. Several thousand dollars could perhaps be saved by changing this policy.

5. Convert Completely To Third Party Scaling (TPSO)

Third party scaling offers two distinct advantages to the government: (1) it saves person-years worked (FTE's), and (2) it is paid out of the value of the timber being sold rather than by appropriated dollars. However, it is not appropriate for across-the-board application. Third party scaling is already being encouraged and expanded, especially in Region 5 where mill deck scaling is being phased out and volumes are adequate to support a TPSO. Also, some internal concern about third party scaling has surfaced (see OIG Audit Report #8622-1-SF).

6. Scale For Gross Volume

Several journeyman scalers were asked to estimate how much scaling time would be saved in labor, training, and quality control if gross scale rather than net scale were used as the primary measure. Average estimates are:

Labor	33%
Training	50%
Quality Control	33%

Obviously, gross scale would cut costs, but such a drastic change could cause serious problems. Log scaling to determine net volume evolved out of necessity during the harvest of valuable old-growth timber, which is highly variable in defect. As old-growth forests are converted to young forests, it is reasonable to conclude that defect will become less significant and scaling will be replaced by more cost-effective ways of measuring and selling timber. At least in the short-term, scaling based on net volume should be used when defect is significant and timber values are high. If it is prudent to scale on the basis of gross volume or estimated net volume, it would be more cost-effective to use pre-sale tree-measurement or other methods not requiring scaling.

7. Require a Significant Increase in 3-P Sample Scaling

3-P scaling procedures could be expanded to include at least 33% of the volume being scaled in Regions 1, 3, and 4 and 10% of the volume being scaled in Regions 5 and 6. This recommendation would place emphasis on one type of sample scaling rather than sample scaling in general. 3-P sample scaling is simply another tool in the manager's box, rather than a unique scaling method to be singled out and treated differently from other sample scaling methods. However, it offers significant opportunity for cost savings and should be encouraged. Region 2's highly successful 3-P scaling program shows that there is a wide range of cost saving opportunities in sample scaling.

8. Sale By Tree Count

This alternative entails a tree count in place of log scaling to determine the final volume for payment purposes. Timber volume is cruised and appraised using current methods. After appraisal, the total volume is converted to an average volume per tree. Bidding then involves a value per tree. Final tree count occurs during cruising, prior to felling, or after felling by counting stumps. Each District determines when it is most advantageous to do the counting.

Although this method can reduce costs compared to current methods, the potential savings are not as great as for the other methods considered herein. Therefore, this issue was given no further consideration. The method is allowed by the manual and can be used as deemed necessary.

9. Measure By Truckload

In this alternative volume is bid and sold by the truckload. Truck counts are used instead of scaling. This is currently being used for very low value material, such as firewood. Although this method should be used where appropriate, it was not developed further herein because other options offer greater savings opportunities.

10. Stewardship Sale

The concept of having a purchaser develop his/her own sale proposal, including the silvicultural prescriptions and environmental documents, has merit. However, it is beyond the capability of the team to develop such a proposal in the time available.

APPENDICES

Appendix 1

DATA RECORDERS COST SAVING ANALYSIS

A questionnaire was sent to each Forest in the nation. One purpose of the questionnaire was to develop data on how much time and money was being spent by personnel that could be eliminated by use of electronic data recorders. This included time filling in headings of tally sheets, scale tickets, auditing cruise sheets, tree measurement tally sheets, scale tickets, determining volumes, and keypunching data into Fort Collins by Forest Service personnel.

Out of 119 questionnaires sent out, 88 were returned and 86 were used in this analysis. Some information provided on the questionnaires was not used, due to misinterpretation of questions or specific problems on the Forest that inflated data. The answers provided by the Forests were based on the best information obtainable within the time available to that Forest. In some cases this was only an estimate based on by local knowledge and assumptions. To obtain better information, time studies would have to be set up and the data recorded over a period of several months. However, the team feels that the data developed from this questionnaire does give a good indication of how much time and money is being spent developing volume estimates throughout the nation. The data developed by the PIT does closely parallel the information developed by the National Administration Review Other Business Management Study Team, which evaluated the use of electronic field notebooks.

Potential savings were derived by summarizing the data on the questionnaires. Saving in FTE's were derived by determining the actual time spent by District and Forest personnel to record, audit, and determine sale volumes for each sale. These figures were based on weighted averages determined from the questionnaires. Savings in dollars were derived by the same method, using the Forest's costs for the above work for each sale. The figures were then expanded by the total number of sales listed by the reporting Forests to determine total savings. All of this time and money can be eliminated by the use of electronic data recorders.

Computations for these savings follows:

Tree Measurement Sales

	Minutes Per Sale	$ Per Sale	No. Sales
Preparing cruise and marking tally sheets (includes filling in headings, changing sheets, setting up sample interval on marking sheets, counting trees for payment units, etc.).	115	26.50	1799
Auditing cruise and tally sheets by RD and SO.	311	52.40	1799
Determining volumes or keypunching by FS personnel.	190	29.30	809
Contract keypunching for volumes.		40.00	990

Expanding this data by the number of reported tree measurements sales gives the following gross savings -

- 7.4 person years and $205,245 per year.

Log Scaled Sales

	Minutes Per Sale	$ Per Sale	No. Sales
Prepare cruise sheets	114.6	24.48	1310
District Ranger audit	96.7	25.07	1310
Determine cruise volume	149.4	23.09	1310
Prepare scale tickets	106.3	17.48	369
District Ranger audit	1904.5	407.88	369
SO audit	478.9	81.44	369
Determine volumes, FS contract data keypunching		92.00	115

Expanding data by the number of reported log scale sales gives the following gross savings -

- 20.4 person years and $462,791 per year.

Combining the data for tree measurement and log scaled sales gives a total savings of 27.8 FTE's per year and a total gross savings of $668,036 per year.

A large purchase cost for the electronic data recorders will be incurred to implement this recommendation. Recorders vary in software and capability and range in cost from $200 to over $4500. Ranger Districts needs will vary greatly. The PIT did not estimate these needs for each Forest or Region but assumed that the average cost per recorder would be $2200. Some Districts will not have enough work to justify purchasing a data recorder, some will need only one, while others will need up to five. The team assumed that 850 recorders would be needed nation-wide.

The purchase of 850 recorders at $2200 each would cost $1,870,000. Maintenance would cost approximately $100 per year per unit after a one year warranty, or $85,000 per year for the 850 recorders. Based on information from dealers and experience of personnel, an average recorder life of eight years is expected.

The following net saving is therefore expected:

Total gross savings	= $668,036 x 8 years	=	$5,344,288
Cost of 850 recorders x $2200		=	1,870,000
Maintenance $100 x 850 recorders x 7 years		=	595,000
Total net savings		=	$2,879,288

Annual expected savings over the eight year period is 27.8 FTE's and $359,911.

Appendix 2

SAMPLING ERROR CRUISING STANDARDS

Region	Scaled	Maximum Sampling Error Premeasured		Standard Deviation
1	10%	<$25M	5%	1
		$25M to $50M	4%	
		$50M to $100M	3%	
		>$100M	2%	
2	conifers 16%	>1MMBF conifers	12%	2
	aspen 20%	aspen	16%	
	salvage 30%	salvage	30%	
		<1MMBF confiers	16%	
		aspen	20%	
		salvage	30%	

Appendix 2
SAMPLING ERROR CRUISING STANDARDS

Region	Scaled	Maximum Sampling Error Premeasured		Standard Deviation
3	10%	TM* <$50M	5%	2
		$50M to $100M	5%	
		$100M to $200M	3%	
		<$200M	4%	
4	7%		5%	1
5	6.25%	with F,B&S**		1
		- defect <20%	3%	
		without F,B&S		
		- defect <20%	5%	
6	green 5%	dead LPP	10%	1
	salvage 10%	other	5%	
8		<$10M	15%	2
		$10M to $50M	12%	
		$50M to $100M	12%	
		$100M to $150M	7%	
		$150M to $200M	6%	
		$200M to $450M	5%	
		>$450M	3.5%	
9		>$5M	10%	2
10	with F,B&S 10%	with F,B&S	7.5%	1
	without F,B&S 7.5%	without F,B&S	5%	

* Tree Measurement
** Fall, Buck, and Scale

Calculation of Cost and FTE Savings

A. Cost saving estimates are based on the following assumptions:

1. 18% or approximately $18 million, of the Regions' FY 1984 sale preparation budget of $101.5 million is used in determining presale volume estimates.

2. An estimated overall 10% to 15% reduction in the cost of presale volume determination.

3. Savings of $1.8 to $2.7 million annually beginning in FY 1986.

B. FTE savings estimates are based on:

Average cost of FTE in cruising and tree measurement is $25,000.

Appendix 3

ESTIMATED SAVINGS FOR REDUCED LOG GRADING

A. Estimated Cost

The estimated annual cost of log grading in Region 5 is $225,000, involving four species. Based on the average Region 5 volume sold in FY 1980-82, the unit cost is $0.13/MBF.

Region 6 use of log grading is similar to Region 5. Applying the Region 5 unit cost to the Region 6 average volume sold in FY 1980-82 yields 4,478,700 MBF x $0.13/MBF = $582,000.

Other Regions either do not use log grading or use it on a very limited basis. Therefore, the cost is less. Collectively these Regions are estimated to spend $100,000/year on log grading.

Cost Summary

Region 6	$582,000
Region 5	$225,000
Other Regions	$100,000
Total	$907,000

B. Estimated Savings

1. It is estimated that eliminating over-sampling would save one third of the present expenditure. Since perfection is rarely achieved, assume half of the over-sampling can be eliminated.

   1/6 x $907,000 = $151,000

2. Estimated savings from simplifying or eliminating log grading or tree value estimating are difficult to estimate; each Region must assess its own opportunities. Extrapolating the Plumas NF example of opportunities to Region 5, the savings would be:

Eliminate true fir log grading (32% of R-5 volume x $150,000 est. cost)	$48,000
Eliminate ponderosa/Jeffrey pine log grading eastside pine type. (est. 14% of R-5 volume x $150,000 est. cost)	$21,000
Total	$69,000

   $69,000 divided by $150,000 = 46%

   Assuming similar opportunities to reduce or eliminate log grading exist in other Regions, the potential savings is conservatively estimated at 25% or

   $189,000 ($907,000 - $151,000 = $756,000 x .25 = $189,000)

   Total estimated potential annual savings:

Reduce oversampling	$151,000
Eliminate log grading (selected species and geographic areas)	$189,000
Total	$340,000

Appendix 6

LOG SCALING COSTS

Appendix 6A - ESTIMATED SAVINGS (See Table 1 on Page 16)

	Annual Cost
Approximate volume 100%-scaled annually by a TPSO and the FS is 5.2315 billion BF (excludes consumer scale 13.1 MMBF).	$15,034,000

1. Sample Scale

Using scaling cost/MBF as a constant by method, the cost to sample-load scale 5.2315 billion BF rather than 100% scale would be as follows:

TPSO cost to sample scale is $1.80/MBF.
FS cost to sample scale is $1.61/MBF.

TPSO at $1.80/MBF	x	4,977.5 MMBF	$8,959,500
FS at $1.61/MBF	x	254.0 MMBF	408,940
Total		5,231.5 MMBF	$9,368,440
		Estimated savings:	$5,665,560

2. Sample Weight Scale

Same basis as 1. above, except calculations are based on 100% weight with sample load.

TPSO cost to sample-load scale is $1.80/MBF.
The FS cost changes from $1.61/MBF to $1.16/MBF from sample-load to 100% weight and sample-load, a 27.95% reduction. The assumption is made that a similar reduction would occur for a TPSO. Therefore, the TPSO cost is:
$1.80 MBF x .7205 (1.000 - .2795) = $1.30/MBF

FS cost to scale 100% weight with sample-load scale is $1.16/MBF.

Cost to 100% scale 5,231.5 MMBF		$15,034,000
TPSO at $1.30/MBF x 4,977.5 MMBF		6,470,750
FS at $1.16/MBF x 254.0 MMBF		294,460
Total 5,231.5 MMBF		$6,765,390
	Estimated savings:	$8,268,610

3. 3-P Sample Scale

If 3-P scaling were adopted for all NF volume scaled and Region 2's cost per MBF for 3-P scaling is a representative average, the cost for scaling could be reduced as follows:

Cost to scale	8,462.6 MMBF	$19,518,222
Less Region 2 (presently 3-P scaled)	- 290.0 MMBF	- 56,850
Present volume and value not involved with 3-P scaling	8,172.6 MMBF	$19,461,372

Region 2's scaling cost is $.20/MBF.
$.20/MBF x 8,172,600 MBF $ 1,634,520

Estimated savings: $17,826,852

Appendix 6-B - SOURCE DATA AND SUPPORT CALCULATIONS FROM WHICH FIGURE 1 AND TABLE 1 WHERE DEVELOPED

To illustrate the variety and extent of scaling methods being used by Regions 1 through 6, together with an estimate of cost differentials resulting therefrom, a telephone survey of those Regions was conducted. In each case, the Regional check scaler provided the information. The best information readily available was used with focus on project costs.

The scaling information was compiled by Region and scaling method, and a weighted average was developed to arrive at a cost/MBF for each scaling method.

1. 100% Scaling - Mill Deck - FS Scale

a) Region 4 18.0 MMBF x $ .50/MBF = $ 9,000

b) Region 5 225.0 MMBF x $1.90/MBF = $427,500

c) Weighted average Regions 4 and 5

$$\frac{\$9,000 + \$427,500}{18,000 \text{ MBF} + 225,000 \text{ MBF}} = \$1.80/\text{MBF}$$

2. 100% Scaling - Yard Roll Out - TPSO Scale

a) Region 6

Westside

3,500 MMBF scaled
60% yard roll out at $3.00/MBF

3,500,000 MBF x .6 x $3.00/MBF = $6,300,000

Eastside

1,500 MMBF scaled
90% scaled by TPSO
15% yard roll out (100%)

1,500 MMBF x .9 x .15 = 202.5 MMBF
202,500 MBF at $1.80/MBF = $364,500

Weighted Average West and East Sides

$$\frac{\$6,300,000 + \$364,000}{2,100,000 \text{ MBF} + 202,500 \text{ MBF}} = \$2.89/\text{MBF}$$

b) Region 5

1,125,000 MBF x $2.90/MBF = $3,262,500

c) Weighted Average Regions 5 and 6

$$\frac{\$6,664,500 + \$3,262,500}{2,302,000 \text{ MBF} + 1,125,000 \text{ MBF}} = \$2.90/\text{MBF}$$

3. 100% Scaling - Yard Roll Out - FS Scale

a) Region 1

3.0 MMBF
Scaling cost per load = $35
3,000 MBF at 5 MBF per load = 600 loads
600 loads x $35 per load = $21,000

$$\frac{\$21,000}{3,000 \text{ MBF}} = \$7.00/\text{MBF}$$

b) Region 4

8,000 MBF x $1.80/MBF = $14,400

c) Weighted Average Regions 1 and 4

$$\frac{\$14,400 + \$21,000}{3,000\ MBF + 8,000\ MBF} = \$3.22/MBF$$

4. 100% Scaling - Truck - TPSO Scale

a) Region 5

150,000 MBF x $2.90/MBF = $435,000

b) Region 6

3,500 MMBF scaled
40% truck at $3.00/MBF

3,500,000 MBF x .4 x $3.00/MBF = $4,200,000

c) Weighted Average Regions 5 and 6

$$\frac{\$435,000 + \$4,200,000}{150,000\ MBF + \$1,400,000\ MBF} = \$2.99/MBF$$

5. Combining 100% Yard Roll Out and 100% Truck Scale By TPSO

a) Regions 5 and 6

Type	Region	Volume (MMBF)	$/MBF	Value ($)
Yard	5	1,125.0	2.90	3,262,500
Yard	6	2,302.5	2.89	6,664,500
	Subtotal	(3,427.5)		(9,927,000)
Truck	5	150.0	2.90	435,000
Truck	6	1,400.0	3.00	4,200,000
	Subtotal	(1,550.0)		(4,635,000)
	Total	4,977.5		$14,562,000

b) Weighted Average

$$\frac{\$14,562,000}{4,977,500\ MBF} = \$2.93/MBF$$

6. Sample Load - TPSO Scale, Region 6

1,500 MMBF scaled
90% scaled by TPSO
85% yard roll out (sample)

1,500 MMBF x .9 x .85 = 1,147.5 MMBF
1,147,500 MBF x $1.80/MBF = $2,065,500

7. Sample Load - FS Scale

a) Region 1

1,100 MMBF scaled
3 MMBF scaled at 100%
25% sample load

(1,100 MMBF - 3.0 MMBF) x .25 = 274.25 MMBF
274.25 MMBF at 5.0 MBF per load = 54,850 loads
Average 1 in 5 sample
54,850 loads ÷ 5 = 10,970 scale loads
Scaling cost $35.00 per load
$35.00 per load x 10,970 loads = $383,950

$$\frac{\$383,950}{274,250 \text{ MBF}} = \$1.40/\text{MBF}$$

b) Region 3

161,102 MBF x $121/MBF = $194,933

c) Region 4

72,000 MBF x $1.76/MBF = $126,720

d) Region 6

1,500 MMBF scaled
10% sample load - FS scale

1,500 MMBF x .10 = 150 MMBF
150,000 MBF x $2.35/MBF = $352,500

e) Weighted Average Regions 1, 3, 4, and 6

$$\frac{\$383,950 + \$194,933 + \$126,720 + \$352,500}{274,250 \text{ MBF} + 161,102 \text{ MBF} + 72,000 \text{ MBF} + 150,000 \text{ MBF}}$$

$$= \frac{\$1,058,103}{657,352 \text{ MBF}} = \$1.61/\text{MBF}$$

8. 100% Weight and Sample Load - FS Scale

a) Region 1

1,100 MMBF scaled
3 MMBF scaled at 100%
75% of the total volume 100 wt. and sample load scaled

(1,100 MMBF - 3.0 MMBF) x .75 = 822.75 MMBF
822.8 MMBF at 5.0 MBF per load = 164,560 loads
Average 1 in 6 sample
164,560 loads ÷ 6 = 27,427 scale loads
Scaling cost $35.00 per load
27,427 loads x $35.00 per load = $959,945

b) Region 3

169,346 MBF x $.88/MBF = $149,024

c) Region 4

131,000 MBF x $1.48/MBF = $193,880

d) Weighted Average Regions 1, 3, and 4

$$\frac{\$959,945 + \$149,024 + \$193,880}{822,750\ \text{MBF} + 169,346\ \text{MBF} + 131,000\ \text{MBF}}$$

$$= \frac{\$1,302,849}{1,123,096\ \text{MBF}} = \$1.16/\text{MBF}$$

9. 3-P Scaling, Region 2

135,000 MBF x $.18/MBF = $24,300 (Black Hills)
155,000 MBF x $.21/MBF = 32,550 (other areas)

Total: 290,000 MBF at $56,850 or $.20/MBF

Appendix 7

COST AND SAVINGS ESTIMATES FOR LESS EXPENSIVE METHODS OF SELLING SALES

Appendix 7A - SUMMARY OF COST ESTIMATES FOR TABLE 2

From PIT questionnaire:

Tree measurement cruises	=	$2.74/MBF
Scaled sale cruises	=	$1.21/MBF
Weighted average	=	$1.55/MBF
Scaling cost	=	$1.84/MBF
Log accountability related to scaling	=	$0.19/MBF
Total scaling cost including log accountability	=	$2.03/MBF

Other assumptions:

11.7 billion board feet sold each year
2.6 billion board feet tree measurement
9.1 billion board feet scaled by Forest Service or third-party

Appendix 7B - SAVINGS CALCULATIONS (Unit costs are from PIT questionnaire)

a) 10% of volume by no intensive cruising and no scaling

Cruise 11.7 x .10 = 1.2 billion board feet
1.2 billion BF x $1.55/MBF = $1.9 million

Scale 1.2 billion BF x $2.03/MBF = $2.4 million

Total = $4.3 million

b) 25% of volume by no intensive cruising and no scaling

Cruise 11.7 x .25 = 2.9 billion board feet
2.9 billion BF x $1.55/MBF = $4.5 million

Scale 2.9 billion BF x $2.03/MBF = $5.9 million

Total = $10.4 million

DATA COLLECTION QUESTIONNAIRE

Reply To: 1340 Management Improvement Date: May 21, 1984

Subject: Sale Volume Determination
Productivity Improvement Team

To: All Forest Supervisors

The Sale Volume Determination PIT team is looking at several issues concerning the way we do business in the area of preparing and selling timber. In order to develop estimates of costs and potential savings, we need your help in answering the attached questionnaire. Please give us your best effort possible under the time constraints available. We don't expect you to do a detailed analysis to develop these answers, but by using the knowledge available on the Forest and Ranger Districts give us the best answers available.

Would you have the questionnaire filled out and returned to us by June 7, 1984? We apoligize for the short time period, but to meet our time constraints we need the questionnaire back as soon as possible.

We appreciate your participation. If you have questions concerning the questionnaire, call Jack Reichert at 501-321-5220 or FTS 740-8220.

Sincerely,

Gary Allen TMO Payatte NF	Joe Barratt TMO Plumas NF	Jim Gladen DR, Sandpoint RD Idaho Panhandle NFs
Bob Devlin FS Rogue River NF	Jack Reichert Silviculturist Ouachita NF	Dave Spores TM Staff Assistant Washington Office

General Questions:

1. Are you now using data recorders on the Forest?

   Yes _____ No _____

2. If so, for what purpose? _____
   _____
   _____

3. Type of recorder being used _____ Cost _____

4. Please provide a list of actual volume sampling errors for sales over 1 MMBF or $5000 cruised - measured during the past year.

5. What is the average stumpage value per unit of measure for sales sold in FY 83? _____

For the following questions your answers should be based on direct project time only. Do not include any overhead costs. Use sales over 1 MMBF or $5000 in value.

Tree Measurement Sales - average per sale:

1. Average number of minutes used to prepare tally sheets or cruise sheets for a tree measurement sale. This would be the time the crew spends heading up sheets, determining sample intervals or changing sheets for different payment units. (Do not include marking time).

   _____ _____
   minutes $ cost

2. How much time is spent by district personnel summarizing these tally sheets, auditing etc. after marking or cruising has been completed?

   _____ _____
   minutes $ cost

3. How much time is spent by S.O. personnel auditing these sheets?

   _____ _____
   minutes $ cost

4. How is data input done for volume determination?

   By ranger district? _____ By S.O.? _____ By contract? _____

5. If data input is done by R.D. or S.O. personnel, how much time is spent per sale to input data?

_____ _____
minutes $ cost

If data input is done by contract, what is the cost per line of input? $_____ and/or per sale? $_____

6. How many tree measurement sales do you make each year which would apply to the above questions? _____

7. How much volume do you sell by tree measurement each year? _____

8. What is your average cost per thousand board feet to cruise (mark) tree measurement sales? $_____ (Do not include time spent marking or unit layout).

8a. What is your average cost per thousand board feet to mark tree measurement sales? $_____ (Do not include unit layout).

9. What is your average cost per thousand board feet to administer the timber sale contract? $_____

Log Scaled Sales - average per sale:

1. Average number of minutes used to prepare cruise tally sheets per sale? This includes direct time for preparing headings, cruise sample, changing sheets, etc. _____ _____
minutes $ cost

2. How much time is spent by district personnel summarizing these cruise sheets, auditing after cruising has been completed?

_____ _____
minutes $ cost

3. How much time is spent auditing these cruise sheets by S.O. personnel?

_____ _____
minutes $ cost

4. How is volume determination done? By district ____ by S.O. _____ Other _____

5. If volume determination is done by district or S.O. personnel, how much time is spent to input the data or determine the volume?

_____ _____
minutes $ cost

6. If volume determination is done by other means, what is the cost?

   $_____ per line and/or $_____ per sale.

7. Average number of minutes used to prepare sheets for log scaling per sale?

   _____ _____
   minutes $ cost

8. How much time is spent by district personnel summarizing and auditing scale sheets per sale?

   _____ _____
   minutes $ cost

9. How much time is spent by S.O. personnel auditing scale sheets?

   _____ _____
   minutes $ cost

10. How is volume summarized from scale sheets? By district _____
    By S.O. _____ Other _____

    If done by District or S.O., how much time is spent summarizing the volume or on data input?

    _____ _____
    minutes $ cost

    If done by other means, what is the cost for data input?

    $_____ $_____
    by line avg per sale

11. How many log scale sales do you make each year which would apply to the above questions? _____

12. How much volume do you sell by scaled sales each year? _____
    MBF

13. What is your average scaling cost per thousand board feet? _____
    (Include the clerical data input and auditing). MBF

14. What is your average cost per thousand board feet to initially cruise scaled sales (Do not inlcude time spent in marking or unit layout)?
    $_____

15. What is your cost per thousand board feet to ensure log accountability after it leaves the woods landing?
$_____

16. What is your average cost per thousand board feet to administer the timber sale contract (costs other than those shown in 13 through 15?

$_____

General Comments:

_____

_____

_____

_____

_____	_____	_____
Forest	Forest Supervisor	Date

Return by June 6, 1984 in the enclosed envelope to:

Jack Reichert
Ouachita National Forest
P.O. Box 1270
Hot Springs, AR 71902

*U.S. GOVERNMENT PRINTING OFFICE: 1985-460-941:20054-FS